

10 to 20 per cent. of the change is completed, then more rapidly until about 60 per cent. is reached, and then again slowly. He also shows that the greater the molecular weight of the acid the more rapidly is the period of maximum action reached. In these phenomena we have fresh examples of the so-called "Chemical Induction" of Bunsen and Roscoe. This supposed special phase of chemical change would indeed appear to be of very frequent occurrence, being only absent in those changes—if such exist—which consist of a single part, the direct change only.

BERTHELOT, in the *Comptes rendus* of the Paris Academy, describes experiments which lead him to believe that by the electrolysis of dilute sulphuric acid a new oxide of sulphur— $S_2O_7$ —is produced. This substance belongs to the class of peroxides, and is analogous with ozone and hydrogen peroxide; the formation of each of these substances is attended with absorption of heat. From the study of the thermal changes accompanying the solution of chlorine in aqueous hydrochloric acid and in water, the same author thinks that a trichloride of hydrogen,  $HCl_3$ , probably exists.

BOUSSINGAULT, in *Annales Chim. Phys.*, has examined the action of heat on barium dioxide under diminished pressure, and has shown that in a vacuum this substance parts with oxygen at a low red heat, and that oxygen is readily absorbed from the atmosphere by the baryta thus produced at about the same temperature, under ordinary pressures. It seems therefore that baryta may be employed as a carrier of oxygen from the atmosphere; hitherto the high temperature required for the decomposition of barium dioxide has brought about some molecular change in the baryta produced, which has rendered it incapable of absorbing more than very small quantities of oxygen from the atmosphere.

In *Comptes rendus*, Hautefeuille states that he has obtained crystals of orthoclase and of quartz in the same tube by heating a mixture of acid potassium phosphate—previously fused with silica and alumina—with silica and a little potassium fluosilicate in a glass tube.

RADZISZEWSKI in Liebig's *Annalen* gives a careful study of the conditions under which various carbon compounds exhibit phosphorescence; he concludes that this phenomenon occurs with those compounds which combine, in presence of alkalis, with the active oxygen of ozone or other peroxide. Phosphorescence he regards as a special case of the phenomenon of combustion; during slow oxidation active oxygen is produced; hence it is in such processes of oxidation that phosphorescence is noticed. When oxidation is rapid much of the active modification of oxygen is produced, combination occurs rapidly between this and the oxidising substance, and we have the phenomenon of combustion. The phosphorescence of certain organised creatures is due, according to the author, to the slow oxidation, by the agency of active oxygen, of such compounds as lecithin, cholesterolin, spermacetti, myricylic alcohol, sugar, fats, or ethereal oils. He shows that these substances are decomposed by cholin and neurin, and generally by bases of the formula  $R_3N.OH$  (where R is a monovalent alcoholic radicle, e.g.,  $CH_3.C_6H_5$ , &c.), and that this decomposition is attended with phosphorescence.

A SMALL pamphlet, "Report on Two Kinds of Coal submitted by the Chesapeake and Ohio Railroad Coal Agency," published by the Bureau of Steam-Engineering of the U.S. Navy Department, contains a detailed account of the methods of determining on the large scale the relative ratios of steam coals, which must be of very considerable service to any who require to perform such determinations.

If aluminium hydrate, obtained by precipitating a solution of alum by ammonia, be allowed to remain in contact with water for three or four months, it undergoes, according to M. Tommasi (*Comptes rendus*), a molecular change whereby it is rendered very much less soluble in acids, and is no longer capable of forming a compound with aluminium chloride.

### PHYSICAL NOTES

THE conditions of geysers are investigated at length by Herr Otto Lang in a recent paper to the Göttingen Society of Sciences (*Nachr.*, No. 6). The theory of Bunsen he considers inadequate, and he proposes another, which has an interesting similarity to that of Mr. Mallet regarding the mechanism of the intermittent volcano at Stromboli.

OBSERVATIONS as to the changes of length of iron bars through magnetisation having been somewhat discordant, Prof. Righi has lately taken up the subject afresh (*Il Nuovo Cim.*, ser. 3, tom. vii.), and, to measure the displacements, he attached a fine steel spring, with mirror, to one end of the bar (which was magnetised by means of a spiral), the mirror being observed through a telescope. Changes in length were thus magnified 8,000 times. The results were as follows:—1. Magnetism produces in iron and steel an increase of dimension in direction of the magnetisation. 2. On cessation of the magnetising force a part of this increase remains, and more or less of it according to the coercive force. 3. The elongations are proportional to the square of the current's intensity when this is not very great. 4. When, after a strong current through the spiral, a weak current is sent in the opposite direction, it produces a shortening; but even when it is strong enough to demagnetise the bar, the latter retains a greater length than in the normal state. 5. During reversal of the polarity of a bar its length becomes momentarily less, and it oscillates in length. 6. A bar or wire of iron traversed by a current contracts at the moment of closing the circuit. 7. On opening the circuit it elongates, but this elongation is less than the initial contraction, indicating that transverse magnetism partly remains. 8. In reversal of the transverse polarity the bar elongates for a moment, and thus oscillates in length. 9. The contraction produced by the current is greater when the bar has before been longitudinally magnetised. 10. Some iron bars show a tendency to take spiral magnetisation, i.e. to rotate the magnetic axes of their molecules in the direction of the spiral. This is shown by the contractions caused by a current passing through the bars, which are different according to the direction of the current and that of the previous longitudinal magnetisation.

THE absorption of radiant heat in gases and vapours form the subject of a recent valuable paper to the Vienna Academy (July 1) by Messrs. Lecher and Pernter. They consider "vapor-hesion" to have been an important source of error in Tyndall's experiments. In their own method the thermopile and the heat-source were brought into the same vessel. Air-currents were avoided by causing the surface of radiation to be heated in each case suddenly from without, by means of a steam jet, to 100° C. Among other results the absorption of water-vapour is found, in opposition to Tyndall, immeasurably small. Violle found, on Mont Blanc, that a metre of the air absorbed only 0.007 per cent. of the whole radiation; according to this, a layer of 300 m. length would be necessary to produce, with water-vapour saturated at 12°, that absorption which Tyndall obtains in 1.22 m. This and the authors' own experimental results are considered to prove beyond dispute the very small absorption of aqueous vapour. The authors' results for gases agree pretty well with Tyndall's. No simple connection between absorption and pressure of the substance was discoverable. The absorption, even for radiation of a heat-source of 100° C., is selective. The authors found the absorption of certain substances of the fat series examined to increase rapidly with increasing proportion of carbon. It seems to be otherwise, however, with bodies from other groups; thus, e.g. benzol, notwithstanding its six C-atoms, has a fairly small absorptive power.

MESSRS. A. P. LAURIE and C. I. BRUTON of Edinburgh have devised a new electromotor engine, in which four electromagnets act successively upon an eccentric armature of soft iron rotating about a central shaft, thus avoiding the back pull of Froment's and other forms of electromotor. The gradual approach thereby secured between the armature and the active field-magnets is a feature common to this engine and to that of Mr. Wiesendanger. The principle has long been applied, though somewhat differently, in the little motors employed for whirling Geissler's tubes.

SIGNOR MACALUSO has recently described a new form of mercurial air-pump, on the Sprengel principle, sufficiently simple to be capable of construction from the materials at hand in any chemical laboratory, and requiring no india-rubber connections. An outline diagram of the pump is given in the August number of the *Beiblätter*.

HERR A. SCHERTEL has determined the fusing-points of a number of difficultly-fusible substances by comparing them with those alloys of gold and platinum in various proportions. He gives the fusion-point of basalt as 1,166° C.; that of adularia (from the St. Gotthardt) is stated as being between 1,400° and 1,420°; and nickel between 1,392° and 1,420°.

THE electric conductivity of gas-carbon and its variability under pressure has been re-examined by MM. Naccari and Pagliani. Carbon prisms were carefully covered at certain points of their surface with copper by electro-deposition to secure good contact with the wires by which they were inserted in a Wheatstone's bridge to determine their resistance. When subjected to great pressures the resistances of the rods of carbon showed scarcely any change. Hence it appears that the changes of conductivity which carbon exhibits in the microphone and in the carbon telephone under varying pressures are due not to any alteration of the contact between the particles in the intimate structure of the substance, but to mere changes in the external contact.

DR. WERNER SIEMENS has lately described to the Berlin Academy a new series of experiments on the electric conductivity of carbon, and the way it is affected by temperature. He finds that of gas retort carbon at  $0^{\circ}\text{C}$ .  $0.0136$  (mercury = 1), and the coefficient of increase of conductivity  $0.000345$  per degree Celsius. The artificial carbon rods produced by compression of carbon powder also show greater conducting power with increasing temperature, but the increase is not so great (as in retort carbon). Dr. Siemens thinks other experimenters may have been led to erroneous results by faulty connections. He effected the union of the carbon ends with the conducting wires by means of galvanic coppering. The property of conducting better at higher temperatures is regarded as a property of the carbon material itself, not as a consequence of its structure. It may be explained (Dr. Siemens says) as in the case of crystalline selenium, if we assume that the carbon is an allotropic modification (containing latent heat) of a hypothetical metallic carbon.

IN his theory of the bifilar magnetometer Gauss considered that the torsion of the suspending wires, and the induction of the earth's magnetism on that of the suspended magnet, might be neglected, as very small. In the course of several years' observations, Herr Wild having found this to cause serious discrepancy between theory and experience, has (at Pawlowski Observatory) developed the theory anew, taking account of those two factors. Substituting cocoon-threads for wires, he considers the moment of torsion can be reduced to considerably less than  $0.3$  per cent. of the moment of gravity (it was more than  $5$  per cent. with wires). The improved theory, while agreeing much better with experience, affords an excellent method of determining separately, from direct observation of the angle of torsion and the three durations of vibration of the magnet in the normal, reversed, and transverse position, its two kinds of induction-coefficients, viz., that in weakening, and that in increase of the magnetic moment by induction; also of determining the temperature-coefficient of magnets and of absolute measurement of the horizontal intensity (*Wied. Ann.*, No. 8).

It appears from recent experiments by Herr Knoblauch (*Wied. Ann.*, No. 8) that in reflection of polarised heat-rays from metals, the rays of different heat-colours behave differently, in that they have in general different angles of polarisation, presenting, in the case of certain metals, as gold and silver, great differences, and in that of others, as copper and speculum metal, smaller. In the case of lead and arsenic these differences wholly disappear. With the former metals the transitions in reflection of different rays from linear to elliptic vibrations do not keep equal pace with each other; changing the angle of incidence from  $0^{\circ}$  to the angle of polarisation, the transformation of the vibration of one heat-tint is prominent, while in change of incidence from  $90^{\circ}$  to the angle of polarisation, it is that of another. With lead and arsenic, at all angles of incidence from  $0^{\circ}$  to  $90^{\circ}$ , the ellipses of certain constant heat-rays are always more extended than those of the other heat colours.

### GEOGRAPHICAL NOTES

THE full details of the Franklin Search Expedition published in the *New York Herald* of September 23 and following numbers do not contain much of scientific interest in addition to what we gave last week. The narrative contains a graphic and interesting account of the sledge journeys of Lieut. Schwatka's party, of the various Eskimo tribes met with, of the country traversed, and the remains of the Franklin Expedition. Some precision is given to our knowledge of the country, and many valuable hints given as to how to brave an Arctic winter. Although the extreme cold endured,  $103^{\circ}\text{F}$ . below freezing, is not so great as has been experienced in one or two previous

instances, we question whether an average temperature of  $100^{\circ}$  of frost for 16 days was ever before met with. A good many interesting relics of the Franklin party were collected, and there seems no doubt that the Eskimo did at one time have a number of books in a tin box belonging to the party who left the ships; but these, with gold watches and other mysteries, were given to the children for playthings, and have long ago disappeared. It is probable enough that among the books were some records of the progress of the expedition; but all hope of recovering them may now be abandoned. We trust that there will be no delay in the publication of the scientific observations which were doubtless made by Lieut. Schwatka's expedition.

THE new number of the Geographical Society's *Proceedings* provides us with an unusual supply of good readable papers of moderate length. Lieut. G. T. Temple furnishes "Notes on Russian Lapland," accompanied by a new map; the Rev. W. G. Lawes, the well-known missionary, "Notes on New Guinea and its Inhabitants"; the Rev. C. T. Wilson, lately of the Nyanza mission, a brief narrative of a journey over new ground in East Africa from Kagéi to Tabora; and lastly, Major W. M. Campbell, R.E., an account of his visit to the previously unknown (except from hearsay) Shorawak valley and the Toba plateau, Afghanistan. The Geographical Notes supply particulars regarding the murder of Messrs. Carter and Cadenhead in East Central Africa, and Capt. T. L. Phipson-Wybrants' expedition to Umzila's country, east of Matabele-land, as well as a French surveying expedition for West Africa. These are followed by a *résumé* of some of Père Duparquet's notes on Orampo-land, an Egyptian exploring expedition in Somali-land, M. Regel's journey in Eastern Turkestan, and a summary of the Indian Marine Survey Report for 1878-79. There are also some useful additions to our knowledge of Eastern Perak, and an abstract of a Consular report on the Chinese province of Shantung. We must not omit to mention that the present number contains the map (postponed from last month) of the country between Sind and Candahar, showing the course of the proposed railway, on which Sir Richard Temple recently lectured before the Society and at Swansea.

THE new expedition despatched by the London Missionary Society to Lake Tanganyika, and consisting of the Revs. A. J. Wookey and D. Williams, with Dr. Palmer, left Zanzibar on June 14, and crossing to the mainland at Saadani, marched thence to Ndumi. Here they remained for a few days, until they got their full complement of *pagazi*, and finally started for the interior on June 21. Accomplishing some twelve or fifteen miles a day, they reached Mpedapwa on July 14, and were most kindly received by the Church Missionary Society's agents. They were to recommence their journey to the lake on July 19. Their caravan consists of 309 men, the chief of whom is Ulia, who accompanied the Rev. Roger Price, when the bullock-waggon experiment was tried some four years ago.

FROM a letter in *L'Exploration* we learn that M. Wiener had in July reached Archedona, in his exploration of the Napo, one of the great tributaries of the Amazon; unless he meets with disaster, we may expect to hear of him by and by from Pará.

THE *Mittheilungen* of the German African Society, of which six parts are published, contains much very valuable information on recent exploration in Africa by German explorers. We have details of the progress of Herr Schütt's expedition in the Loanda region, of Rohlf's attempt to push southwards from Tunis, of Dr. Büchner to Muata Janvo's kingdom, of Dr. O. Lenz's determined and so far successful attempt to push southwards through Morocco to Timbuctoo and beyond. We have, besides, records of the doings of the International African Association, and of the various other societies for the exploration of Africa throughout the world. In the double number, 4 and 5, Dr. Reichenau gives a detailed list of the collection of birds sent home from Malanga in Angola by Herr Schütt.

A TELEGRAM from New York, October 5, states that the commander of the United States steamer *Alert* reports the discovery of a submarine volcano near San Alessandro, an island in the Pacific.

THE eruption of the volcano Fuego in Guatemala, to which we referred some weeks ago, ceased almost suddenly in the second half of the month of July. M. de Thiersant, French representative in Guatemala, writes to *La Nature* that another volcano of the same country, Pacaya, seems inclined in its turn to resume activity. At Amatitlan, a small town on the slope of